Specification

Title of the Invention

Radio Communication Connection Destination

Specifying Method

5

Background of the Invention

The present invention relates to a radio communication connection destination specifying method suitable for a radio communication system using a radio
10   wave with weak directivity and, more specifically, to a radio communication connection destination specifying method which can easily specify a connection destination by using infrared radiation with strong directivity for radio communication between electronic information
15   communication devices in a radio communication system.

Conventionally, communication connection between electronic information communication devices is generally done by a wire scheme. Recently, attempts have been extensively made to increase the usability
20   using a radio scheme instead.

An example of a radio communication system using a radio wave that has already been put into practical use and proliferated is an IrDA (Infrared Data Association) system using infrared radiation with strong
25   directivity for radio communication between electronic information communication devices. In the IrDA system, however, the light-emitting surface (transmitting

surface) and light-receiving surface (receiving surface)
of opposing electronic information communication devices
must face each other without being shielded by any
obstacle. For this reason, the use environment is
5   limited to some extent.

A radio communication system capable of
eliminating such limitation on use environment has also
been proposed. For example, in a Bluetooth system using
a radio wave with weak directivity, electronic
10   information communication devices in an about 10-m
radius area can be wirelessly connected using a radio
wave. Such a radio communication system has no
limitation on use environment, unlike the IrDA system,
and is therefore expected to widely proliferate in the
15   future.

Examples of general radio communication
techniques between electronic information communication
devices are disclosed in Japanese Patent Laid-Open
No. 10-135910 "microcomputer mounted control panel and
20   parking lot management system provided with control
panel", Japanese Patent Laid-Open No. 11-112643
"hand-free speech device", and Japanese Patent Laid-Open
No. 11-261738 "speaking system in portable telephone".

To specify a connection destination in
25   communication connection between electronic information
communication devices, in the wire scheme, the
electronic information communication devices are

physically connected through a cable. In the IrDA scheme, the electronic information communication devices are physically made to face each other. To the contrary, the above-described Bluetooth system cannot be achieved

5 using the above-described physical method. Since it is necessary to specify the connection destination by a logical identifier, the connection scheme becomes complex, and the connection destination cannot be easily specified.

10 Figs. 6A to 6C show a procedure of specifying a connection destination in a conventional Bluetooth system.

In the conventional Bluetooth system, to specify a connection destination, at the initial phase,

15 a portable telephone 3 serving as a main electronic information communication device transmits an inquiry request to wireless headsets 1 and 2 serving as peripheral electronic information communication devices, and each of the wireless headsets 1 and 2 returns an

20 inquiry response (Fig. 6A). Next, at the intermediate phase, the user selects by key operation a desired connection destination (wireless headset 1) from the pieces of identification information of the wireless headsets 1 and 2 that have returned the inquiry

25 responses and are displayed on a display screen 3a of the portable telephone 3 (Fig. 6B). At the final phase, a Bluetooth link is established for the wireless headset

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1, i.e., the connection destination selected by the
portable telephone 3 (Fig. 6C).

In the above-described Bluetooth system, a
Bluetooth device address serving as an identifier is
5   used as the device identification information of each of
the wireless headsets 1 and 2. However, since the
Bluetooth device address is a combination of a
predetermined number of numbers and characters, the
connection destination actually desired by the user can
10   hardly be specified from the device list sent to the
portable telephone 3.

That is, even when a method of displaying the
identifiers (device identification information of the
wireless headsets 1 and 2) on each electronic
15   information communication device (portable telephone 3)
is applied, the user must know in advance the identifier
(device identification information of the wireless
headset 1 or 2) of the electronic information
communication device as a desired connection destination.
20   The reason for this is the same as in a normal telephone
call, i.e., the user cannot make a telephone call unless
he/she knows the telephone number of the other party in
advance.

Summary of the Invention

25   It is an object of the present invention to
provide a radio communication connection destination
specifying method which can easily specify a connection

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destination by a user in radio communication between electronic information communication devices.

In order to achieve the above object, according to the present invention, there is provided a radio communication connection destination specifying method of establishing a link between electronic information communication devices in a radio communication system which executes radio communication using a radio wave, comprising the steps of transferring device identification information of an electronic information communication device of a connection request source to an electronic information communication device of a connection request destination using, as radio communication, radio communication with strong directivity, and causing the electronic information communication device of the connection request destination to specify the electronic information communication device of the connection request source on the basis of the transferred device identification information and to establish the link.

Brief Description of the Drawings

Figs. 1A to 1C are views showing procedures at the initial, intermediate, and final phases in specifying a connection destination in a Bluetooth system using a radio communication connection destination specifying method according to the first embodiment of the present invention;

Fig. 2 is a flow chart showing processing operation on the wireless headset side shown in Figs. 1A to 1C;

Fig. 3 is a flow chart showing processing operation on the portable telephone side shown in Figs. 1A to 1C;

Fig. 4 is a view showing a frame format output and transmitted from the wireless headset shown in Figs. 1A to 1C by the IrDA;

Figs. 5A to 5C are views showing procedures at the initial, intermediate, and final phases in specifying a connection destination in a Bluetooth system using a radio communication connection destination specifying method according to the second embodiment of the present invention; and

Figs. 6A to 6C are views showing procedures at the initial, intermediate, and final phases in specifying a connection destination in a conventional Bluetooth system.

Description of the Preferred Embodiments

The present invention will be described below in detail with reference to the accompanying drawings.

Figs. 1A to 1C show the procedures of specifying a connection destination in a Bluetooth system using a radio communication connection destination specifying method according to the first embodiment of the present invention. In this Bluetooth

system, wireless headsets 11 and 12 can transmit/receive voice data to/from a portable telephone 31 by the Bluetooth scheme without holding the portable telephone 31 by a hand. The portable telephone 31 has a Bluetooth

5   interface and IrDA interface. The Bluetooth interface is used for an application purpose with a relatively long communication time, such as voice data transmission with respect to the wireless headset 11 or 12 or data communication with a personal computer (not shown). The

10   IrDA interface is used for an application purpose with a relatively short communication time, such as electronic card exchange with another portable telephone or PDA (Personal Digital Assistants).

        The wireless headsets 11 and 12 have different

15   pieces of Bluetooth device identification information to identify each other. Each of the wireless headsets 11 and 12 also has a Bluetooth interface and IrDA interface, like the portable telephone 31. The IrDA interface copes with only transmission. That is, since the IrDA

20   interface is used to only one-sidedly always transmit the same frame format, as will be described later, it requires no complex hardware or software for processing the IrDA protocol and therefore has a simple structure. In addition, since the IrDA interface is used for the

25   purpose of specifying a connection device, an arrangement suitable for the purpose is required in terms of directivity of light or communication range.

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More specifically, preferably, the directivity is ±15″ defined by the IrDA, and the communication range is about 20 to 30 cm.

To specify a connection destination in the Bluetooth system, at the initial phase, the wireless headset 11 serving as a peripheral electronic information communication device that wants connection is made to face the portable telephone 31 serving as a main electronic information communication device. In this state, the wireless headset 11 transmits to the portable telephone 31 as the main electronic information communication device by the IrDA a Bluetooth device address as device identification information necessary for Bluetooth connection (Fig. 1A).

At the intermediate phase, the portable telephone 31 transmits an inquiry request for Bluetooth link establishment to the wireless headsets 11 and 12, and each of the wireless headsets 11 and 12 returns an inquiry response (Fig. 1B). Each returned inquiry response contains a Bluetooth device address as device identification information.

At the final phase, the portable telephone 31 compares device identification information received by the IrDA with each device identification information received by the inquiry response. The portable telephone 31 makes Bluetooth connection to the wireless headset 11 that matches the device identification

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information, thereby establishing a Bluetooth link to the wireless headset 11 as the connection destination (Fig. 1C).

According to this embodiment, even when a device (wireless headset) that does not want connection is present in the Bluetooth area, Bluetooth connection to only a device that wants connection can be automatically done by making the devices that want connection face each other.

The processing operation on the side of the wireless headsets 11 and 12 will be described next with reference to the flow chart shown in Fig. 2.

The wireless headsets 11 and 12 in the power-OFF state (step S1) are powered on by user's power-on operation and shift to an "unconnected state" (step S2). In the "unconnected state (step S2)", a Bluetooth device address as Bluetooth identification information is transmitted to the portable telephone 31 on the basis of a frame format (to be described later) by the Ultra specification (Infrared Data Association Guidelines for Ultra Protocols: October 15, 1997) defined by the IrDA, and then, a Bluetooth connection wait state is set. This Bluetooth connection wait state continues until Bluetooth connection from the portable telephone 31 is made, and a Bluetooth link is normally established. The state shifts to a "connected state (step S3)" wherein a Bluetooth link is established.

In the "connected state (step S3), the wireless headsets 11 and 12 are connected to the portable telephone 31 by Bluetooth connection and set in an operative state. In this state, since the device

5   identification information need not be transmitted by the IrDA, the IrDA interface stops functioning. However, when the user executes power-off operation, the state shifts to a "power-OFF state (step S1)". Alternatively, if the Bluetooth link is disconnected due to some error,

10 the "connected state "step S3" returns to the "unconnected state (step S2)", so the Bluetooth identification information (device identification information) is transmitted and output by the IrDA again every predetermined time.

15   The processing operation on the portable telephone 31 side will be described next with reference to the flow chart shown in Fig. 3.

First, upon receiving a headset connection request by user's operation in a "normal state (step S1),

20 the portable telephone 31 shifts to an "unconnected state (step S2)". The "normal state (step S1)" means that the power of the portable telephone 31 is ON, and no Bluetooth link is established.

In the "unconnected state (step S2)", the

25 portable telephone 31 is set in an infrared receiving state. In this state, when device identification information from each of the wireless headsets 11 and 12

is normally received, the state shifts to "Bluetooth link establishment progressing 1 (step 3)". On the other hand, in case of timeout wherein no device identification information is received within a

5   predetermined time, the state shifts to "Bluetooth link establishment progressing 2 (step 4)".

In the "Bluetooth link establishment progressing 1 (step 3)", inquiry operation (inquiry request) defined by the Bluetooth specification

10   (Specification of Bluetooth Systems, Profiles, Generic Access Profile, December 1, 1999) is performed, and responses (inquiry responses) from active devices in the Bluetooth area are waited. After receiving responses, device identification information (Bluetooth device

15   address) contained in each response is compared with device identification information (Bluetooth device address) received by infrared radiation, and Bluetooth link establishment by Bluetooth connection is tried for a device (wireless headset) that matches the device

20   identification information.

If link establishment is successfully done, the state shifts to a "connected state (step S5)". If no device that matches the device identification information is detected, the state shifts to the

25   "Bluetooth link establishment progressing 2 (step 4)" because selection of a connection destination by the user is necessary. If link establishment fails due to

some error, the state shifts to the "normal state (step S1)".

In the "Bluetooth link establishment progressing 2 (step 4)", inquiry operation (inquiry request) defined by the Bluetooth specification is performed, and responses (inquiry responses) from active devices in the Bluetooth area are waited. After receiving responses, the user is notified of the pieces of device identification information contained in the responses, and Bluetooth link establishment by Bluetooth connection is tried for a device selected by the user. If link establishment is successfully done, the state shifts to the "connected state (step S5)". If link establishment fails due to some error, the state shifts to the "normal state (step S1)".

In the "connected state (step S5)", the portable telephone 31 is connected to the wireless headset 11 or 12, and the transmitting device (microphone) and receiving device (speaker) on the portable telephone 31 side stop. In this state, if user's operation is done or the link is disconnected due to some error, the state shifts to the "normal state (step S1)".

Fig. 4 shows a frame format output and transmitted from the wireless headset 11 or 12 by the IrDA. The Ultra specification applied here is a scheme of one-sidedly transmitting data to the other party in a

nonconnection state, i.e., without any connection protocol in the IrDA. As a characteristic feature, no confirmation ACK (ACKnowledge) is required as a transfer protocol.

5   More specifically, the Payload of the Ultra layer is encapsulated into the Payload of a lower layer, i.e., IrLMP/IrLAP. The Payload of the Ultra layer is formed from two parts, i.e., a protocol identifier (PID) and data (Protocol Data) to be actually transferred. A

10   dedicated code for Bluetooth connection is defined in the protocol identifier, and Bluetooth device identification information (Bluetooth device address) to be actually transferred is laid out in the Protocol Data.

          Upon receiving an Ultra frame, the portable

15   telephone 31 determines on the basis of the protocol identifier stored in the PID field whether the received Ultra frame is a Bluetooth connection frame. Only when it is determined that the Ultra frame is a Bluetooth connection frame, device identification information

20   (Bluetooth device address) is extracted from the Protocol Data field. When the application-specific code of the present invention is defined in the protocol identifier, any reception error for a frame output by another application using the Ultra specification can be

25   prevented.

          Figs. 5A to 5C show procedures of specifying a connection destination in a Bluetooth system using a

radio communication connection destination specifying method according to another embodiment of the present invention.

The Bluetooth system of the second embodiment is different from that of the first embodiment in that a Bluetooth device name is used in place of a Bluetooth device address as device identification information.

To specify a connection destination in this Bluetooth system, at the initial phase, a wireless headset 21 serving as a peripheral electronic information communication device that wants connection is made to face a portable telephone 32 serving as a main electronic information communication device. In this state, the wireless headset 21 transmits to the portable telephone 32 as the main electronic information communication device by the IrDA a Bluetooth device name as device identification information necessary for Bluetooth connection (Fig. 5A).

At the intermediate phase, the portable telephone 32 transmits a name request for Bluetooth link establishment to the wireless headsets 21 and 22, and each of the wireless headsets 21 and 22 returns a name response (Fig. 5B). Each returned name response contains a Bluetooth device name as device identification information.

At the final phase, the portable telephone 32 compares device identification information received by

the IrDA with each device identification information
received by the name response. The portable telephone
32 makes Bluetooth connection to the wireless headset 21
that matches the device identification information,
5 thereby establishing a Bluetooth link to the wireless
headset 21 as the connection destination (Fig. 5C).

According to this embodiment, even when a
device (wireless headset) that does not want connection
is present in the Bluetooth area, Bluetooth connection
10 to only a device that wants connection can be
automatically done by making the devices that want
connection face each other, as in the first embodiment.

In the above-described embodiments, the
portable telephone 31 or 32 and wireless headset 11, 12,
15 21, or 22 serving as electronic information
communication devices are connected by Bluetooth
connection. However, the present invention is not
limited to such a system. The present invention can
also be applied to a Bluetooth system which uses other
20 electronic information communication devices under
similar conditions to connect, e.g., a personal computer
and wireless keyboard by Bluetooth connection.

In the above-described embodiments, the Ultra
specification is applied as an IrDA communication
25 protocol and frame format. However, the present
invention is not limited to the Ultra specification.
For example, any other protocol which requires no

confirmation ACK as a transfer protocol (connectionless

service) and, more particularly, a protocol which uses a

UI frame prepared in the IrDA specification can be used.

A protocol which requires a confirmation ACK

5   (connection-oriented service) may be used. In the

latter case, since the IrDA interface on the side of the

wireless headsets 11, 12, 21, and 22 must cope with

transmission/reception, an IrDA interface of the same

type as that on the side of the portable telephones 31

10   and 32 is required.

In the above-described embodiments, a radio

communication system using a radio wave with weak

directivity has been exemplified, and an IrDA system has

been assumed as a communication system using infrared

15   radiation with strong directivity. However, the present

invention is limited to neither communication systems.

That is, the present invention can be applied to any

other system as long as it uses a radio communication

system using infrared radiation with strong directivity

20   in specifying a connection destination of a radio

communication system using a radio wave with weak

directivity.

As has been described above, according to the

present invention, since link establishment is done only

25   by causing devices that want connection to face each

other, a connection method in a radio communication

system using a radio wave with a weak directivity can be

simplified.   In addition, a connection destination can

easily be specified, and consequently, a connection

destination can easily be specified by the user for

radio communication between electronic information

5   communication devices in a radio communication system.